ENVIRONMENTAL IMPACT ASSESSMENT

PROJECT REPORT FOR

THE PROPOSED APARTMENTS ON PLOT No. RUIRU/RUIRU EAST BLOCK 2/7379 AT KIAMBU COUNTY, RUIRU KIMBO AREA, OFF THIKA-NAIROBI SUPERHIGHWAY.

MARGARET WAIRIMU MBIRA
P.O BOX 1338
LIMURU

(This Environmental Impact Assessment (EIA) Project report is submitted to National Environment Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination Act, 1999 (Amended 2015) and the Environment (impact Assessment and Audit) regulation

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CERTIFICATION

This EIA project report was prepared in accordance with the Environmental Management and Coordination Act (EMCA) 1999 and the Environmental (Impact Assessment) and Audit Regulations 2003 which requires that every development project must have an EIA report prepared for submission to the National Environmental Management Authority (NEMA).

The following EIA Experts conducted the study and prepared this report.

Lead Expert
Hezekia Nelson Otieno
Expert No.2052
nelsonhezzotieno@gmail.com

Signature: _____Date: _____

Associate Expert
Anthony Gitonga
Expert No.9934
tonniegitonga@gmail.com

Signature: _____ Date: _____

Proponent
MARGARET WAIRIMU MBIRA
P.O BOX 1338
LIMURU

Signature: _____ Date: _____

LIST OF TABLES

ABBREVIATIONS

EIA : Environmental Impact Assessment

EMCA : Environmental Management and Coordination Act

NBSAP : National Bio-diversity Strategy and Action Plan

CBD : Convention on Biological Diversity

NEAP : National Environmental Action Plan

EMP : Environmental Management Plan

EHS : Environmental Health and Safety

KPLC : Kenya Power and Lighting Company

OHS : Occupational Health and Safety

EHS : Environmental Health and Safety

WRMA : Water Resource Management Authority

EXECUTIVE SUMMARY

Globalization, urbanization, migration and technological advancements have continued to drive cities forward right from their infant stages, the cyclic processes, growth, through to their renewal and regeneration. More and more people are moving and positioned themselves in cities for business, work, venturing forth and recreation. The demand for Residential space development situation in Kenyan (urban areas) has remained under tremendous pressure. Both the government and private sector have had a role to play, with the government servicing the land and leaving it to private entrepreneurs to develop. The provision of housing has not kept pace with the said phenomenon.

However, the Kenyan government has with great concern realized the pressure for residential/ accommodation sites which have great implication on the service industry and on housing (especially on urban shelter) and has introduced a policy aimed at providing over 150,000 house unit per year; but in line with physical planning policies- Policies in the physical planning and housing sectors are aimed at increasing the supply of standard housing units, water supply and sanitation, channelizing the urbanization and assuring proper urban development and management

Kenya being a developing country is urbanizing very fast and hence experiencing the challenges of urbanization. **MARGARET WAIRIMU MBIRA**herein referred to as proponent has identified an investment opportunity off Thika – Nairobi highway in Ruiru, Kimbo area, Kiambu County. Kiambu County being one of the rapidly developing counties in the country continues to attract and accommodate most of the mega real estate developments. MARGARET WAIRIMU MBIRA(herein referred to as the proponent) has proposed to develop five storey apartments on *Proposed Apartments on Plot No. Ruiru/Ruiru East Block 2/7379 At Kiambu County, Ruiru Kimbo Area, Off Thika-Nairobi Superhighway* Kiambu County. The development will comprise a total of 40 units.

This Environmental Impact Assessment (EIA) project report has critically considered the likely positive and negative impacts of the proposed development in Ruiru, Kimbo area and its neighborhood. Besides, alternatives to the proposed project have been identified and analyzed with the aim of establishing the most sustainable and cost-effective way of mitigating any negative impact that may arise as a result of the implementation of the proposed project.

Scope, Objectives and Terms of Reference (TOR)

Scope

The scope of the study included carrying out of environmental investigations in line with current provisions on environment/legislations. This was done in line with the requirements of Environmental Management and Coordination Act (EMCA) 1999 and Environmental (Impact Assessment) and Audit regulations 2003. The study is aimed at analyzing all the physical extent of the project site and its immediate environs, implementation works of the proposed development (ground preparations, foundation, walling, roofing, fixtures and fittings among other activities. Also taken into consideration, is the installation of key utilities and other facilities required for the optimal functioning of the project.

Overall objective of the project

The proposed project has the overall objective of putting up residential apartments. This will not only attempt to solve the current housing shortage but also meet the economic goals of the proponent and the increasing housing needs of the middle-income City residents while at the same time improving the economy of the country. The aim of EIA study is to evaluate the effects/impacts of proposed development in relation to the general environmental aspects i.e. physical, biological, and social-economic environments. Generally, it seeks to influence the protection and co-existence of the development with the surroundings as well as the compatibility of the proposed development to the area. Eventually, the study will guarantee and augment sustainable environmental management during implementation as well as operation of the project.

Specific Objectives of the study

The key objectives of this study include:

i) To determine the compatibility of the proposed facility with its neighborhood and evaluate the local environmental conditions.

ii) To identify and evaluate the significant environmental impacts of the proposed project.

iii) To assess the environmental costs and benefits of the proposed project to the local and national economy.

iv) To evaluate and select the best project alternative from the various options.

v) To incorporate environmental management plans and monitoring mechanisms during implementation and operation phases of the project.

Terms of Reference (TOR)

The following Terms of Reference (TORs) apply to the project:

i) Hold appropriate meetings with the project proponent to establish the procedures, define requirements, responsibilities and a time frame for the project.

ii) Provide a description of the proposed activities throughout the entire implementation process of the project with a special focus on potential impacts to the surrounding environment

iii) Carry out a systematic environmental assessment at the proposed project site and the surrounding area

iv) Produce an EIA report that contain among other issues potential negative and positive environmental impacts and recommendation of appropriate mitigation measures to minimize or prevent adverse impacts.

v) Develop an Environmental Management Plan and cost estimates for the proposed project.

Consultancy

The EIA project report was written by a lead and associate experts duly registered by The National Environment Management authority-NEMA to undertake an activity of this nature. The study was carried out between 11th June 2020and 12th June, 2020. Over this period, a number of vital data pertaining to the project's design, technology, and legal framework were collected and analyzed.

Methodology

The methodology used in the study consisted of the following.

i) The study assessed and qualified the potential impacts of the proposed project. The baseline information collected was used to analyze the potential impacts of the proposed project. The EIA study team embarked on various methodologies such as literature review, field visits, consultations with the neighbors among others in order

to generate adequate baseline information which served as a benchmark for analyzing potential impacts and generating an Environmental management plan.

ii) The fieldwork was extensive and included several activities. A reconnaissance visit was made to the project area by the EIA team on 10th June 2020. Based on this, the team set out key areas of observation. This was then followed by detailed visits of the project area and neighboring facilities taking records of observations as well as interviewing community members.

iii) Different stakeholders were interviewed to give their views on the expected impacts of the project. Literature review on projects of such nature and their impacts on the environment were done. Environmental management and coordination Act (EMCA) 1999 and other relevant statutes that have a direct significance to the proposed project were reviewed. Other reports and reference materials on physical and biological data on the study area were also studied and reviewed.

iv) A site reconnaissance and visual survey to determine the baseline information of the project area

v) Comparative study of the project with existing land uses in the neighborhood.

vi) Analysis of the project documents

vii) Discussion with the proponents and their consultants

viii) Assessment of the site to detail the various existing and likely impacts.

ix) Assessment of health and safety issues

x) Seeking public views through questionnaires and interviews

xi) Proposal of mitigation measures to minimize any negative impacts.

xii) Preparation and submission of the report

Output

The output of the study is the production of this EIA project report with recommendations to be presented to NEMA for purposes of seeking an EIA license.

Positive impacts

The positive benefits associated with the proposed project include the following:

i) Provision of standard, safe and affordable housing facilities to the public

ii) Economic investment hence employment creation and economic growth Creation of market for goods and services as well as provision of commercial facilities. This will be significant especially during construction period. The goods will be sourced from local suppliers; thus, creating a ready market. Employment opportunities will be created to the watchmen, cleaners, house-helps among others. Other secondary businesses are also likely to come up especially during construction phase; for instance, those selling food to the construction workers.

iii) Improvement of areas general security

iv) Development of Ruiru Kimbo area by making more economic use of land.

v) Provision of Revenue to National and County governments amongst other agencies.

Potential negative impacts associated with the proposed project

There are several potential negative impacts associated with the proposed project. These are anticipated mostly during the construction phase and can easily be mitigated. They include the following:

i) Increased noise and vibrations during construction.

ii) Solid waste and wastewater. There will be increased waste generation especially during construction phase.

iii) Air pollution as a result of dust particles emanating from excavation and construction activities.

iv) Impacts on human health and safety. The health and safety of workers may be an issue during the construction phase.

v) Loss of vegetation at the site and the adjacent area during construction

vi) Dust to the neighboring residential building arising for the construction activities.

vii) Compromised privacy to the neighbors'

viii) Oil Spills from machinery,

ix) Increased water demand,

x) Increased Energy Consumption,

xi) Demand for building materials extracted from natural resource base,

xii) Workers accidents and hazards during construction.

xiii) Traffic congestion and accidents

xiv) Work place accidents

Potential mitigation measures

Mitigation and management measures to minimize and control the negative impacts of the development and to ensure compliance with the relevant environmental legislation and management standards have been integrated in the report. They include:

i) There shall be limited earthworks. Soil compaction and watering of loose soil shall be done on all disturbed areas during construction phase to minimize air pollution (by dust) and erosion by the agents of soil erosion.

ii) To cater for surface drainage, well-designed concrete drain channels have been proposed to harmonize management of the resulting storm water within the site.

iii) To reduce noise pollution, portable barriers to shield compressor and other small stationery equipment where necessary will have noise suppressor or silencers. Noise shield e.g. corrugated iron sheet structure to control noise propagation shall be provided. Workers will be sensitized on the need to switch off engines when not in use and all machinery will be well maintained through regular oiling.

iv) Capacity building and training of personnel with respect to environment, health and safety shall be observed. Personnel protective equipment as per health safety regulations and medical checkup of workers as is required by factories and other places of work Act (cap 514) shall be observed.

v) To reduce health and safety risks, effective emergency response plans will be observed both during construction and operation phase.

vi) During the construction phase, the contractor shall put in place effective and efficient waste disposal systems. Waste, including excavated soil and debris shall be properly disposed of by backfilling and landscaping. The contractor shall provide acceptable and standard sanitary convenience to the workers during construction. Additionally, the contractor shall ensure that trees are preserved around the site, as much as possible to ensure that the adequate vegetation cover is maintained.

vii) The proponent will arrange with contractor to landscape the area and increase tree cover after construction.

viii) The contractor and the site manager will ensure that there are no oil spills in the site during and after the construction.

ix) Water conservation mechanisms will be observed through turning off taps when they are not in use, having water reservoirs within the site.

x) The proponent shall ensure that no waste water or liquid waste is channeled to the nearby river but instead find a sustainable way of disposing waste water without contaminating the adjacent stream,

Conclusion

The proposed development will not have adverse environmental impacts either in the immediate neighborhood or to the entire area at large. The proponent has followed all the legal procedures necessary for the execution of a project of this nature and adequate mitigation measures have been put in place to preclude any negative impacts. The implementation of the project should however be subject to the observance of all the legal and regulatory frameworks governing an activity of this nature. The recommended Environmental Management Plan (EMP) should also be observed throughout the entire life of the project.

CHAPTER ONE: INTRODUCTION

The Kenyan government has with great concern realized significant short fall in housing infrastructure; mostly in the urban areas. This has been caused by the increased rural- urban migration especially in the past two decades, coupled with increased urbanization. In view of the foregoing, the government has come up with a policy document that aims at providing approximately 150,000 new housing units per annum. It has in addition recognized the input of the private sector in providing housing facilities/infrastructure to bridge the gap in the housing sector. This is reflected in the National Housing Policy Sessional Paper No.3 of 2004 which sets out the government role as that of facilitating the private sector, cooperatives, local government and individuals in providing housing and related services. It is upon this background that **Margaret Wairimu Mbira** seeks to put up a residential apartment. Pursuant to the provisions of Environmental Management and Coordination Act section 58 (1) and the Environmental Impact Assessment and Audit Regulations, 2003 part II, an environmental project study was carried out for the proposed residential apartment project. Indeed, the study was conducted with a view of determining the anticipated environmental impacts of the proposed project and to identify the necessary mitigation measures in order to incorporate sustainable development aspects in the project cycle. Eventually the immediate goal of conducting the study was to obtain the necessary approvals and licenses from NEMA so as to proceed with the project.

Kenya being a developing country is rapidly urbanizing; hence, experiencing the challenges of urbanization. The proponent has proposed to develop residential apartment on *Proposed Apartments on Plot No. Ruiru/Ruiru East Block 2/7379 At Kiambu County, Ruiru Kimbo Area, Off Thika-Nairobi Superhighway,* Kiambu County.

Policy makers worldwide promote the need to pursue sustainable development guided by sound environmental, social, cultural and ethical considerations. To achieve these, development plans in both developed and developing countries should be managed to maintain or improve the resource and environmental base on which they depend. This will allow future generations to live equally well as the current generation. The goal of sustainable development cannot be achieved without significant changes in the way's development initiatives have been planned and

implemented. In order to achieve these changes, we must consider as a matter of priority environmental protection and environmental security as essential elements of national and international security. As the sixteenth principle of the world charter for nature adopted by the General Assembly of the United Nations on 28th October 1982 states;" …….All planning shall include among its essential elements, the formulation of strategies for the conservation of nature, the establishment of inventories of ecosystems and the assessments of the effects on nature of proposed policies and activities; all of these elements shall be disclosed to the public by appropriate means in time to permit effective consultation and participation." It is in pursuit of this principal that this environmental impact assessment report has been written.

The need for this project arose out of the desire to; to improve housing industry through provision of housing facilities to meet the increasing demand, to invest in housing for economic gain and to improve the general aesthetics of the area.

1.1 Background and rationale of the EIA project report

In accordance to the Kiambu County zoning ordinances the project area is proposed for residential development. It's thus rational for the project proponent to put up housing apartments to tap on the increasing demand for affordable housing in the area and in the City. This is in attempt to meet the demands of suitable high-end housing facilities among the Ruiru Kimbo and Nairobi Residents. This project will therefore help solve the problem of limited housing facilities faced by Kenyans especially in urban areas such as Ruiru, Thika and Nairobi, while enhancing the growing real estate sector in the country. The proponent's building plans have been approved by the Government of Kiambu County Physical and land use planning department (see appendix).

1.2 Objective

The objectives of the proposed residential flats include;

- To improve housing industry through provision of housing facilities to meet the increasing demand in Kiambu and Nairobi counties
- To invest in housing for economic gain.
- To improve the general aesthetics of the area

Demand for high end houses in Ruiru Kimbo and other parts of Nairobi and Kiambu has increased. By constructing residential Apartments, the proponent will maximize gains from the piece of land as well as increase housing facilities in the area to meet the high demand.

1.3 Specific Objectives of the project

The project proponent aims at achieving the following objectives:

ii) To reduce the current high-end housing shortage by providing affordable residential apartments

iii) Maximize returns on investment for the proponent while taking due consideration of policy, legal and administrative procedures governing the operations of an activity of this nature.

iv) To ensure that the project is in character with the other developments in that area.

v) Ensure that the project activities do not in any way interfere with the environmental sustainability of the area in question giving due consideration to:

- Habitat and vegetation.
- Neighboring population and land uses.
- Changes in the water system resulting from the project construction and operation.
- Increased change in traffic volumes.

vi) Put in place mitigation measures that will ensure that any potential negative impacts resulting from project activities are taken care of at the earliest opportunity to obviate any harmful effect to the neighboring environment.

vii) Contribute to economic growth by providing commercial facilities to the neighborhood as well as boost the economy by providing jobs to the unemployed and market to the suppliers.

1.4 Objectives of the EIA study

The key objectives of this study include:

i) To determine the compatibility of the proposed facility and evaluate the local environment conditions.

ii) To identify and evaluate the significant environmental impacts of the proposed project.

iii) To assess the environmental costs and benefit of the proposed project to the local and national economy.

iv) To evaluate and select the best project alternative from the various options.

v) To incorporate Environmental Management Plans (EMP) and monitoring mechanisms during implementation and operation phases of the project

1.5 Scope of the study

The study has been conducted to evaluate the potential and foreseeable impacts of the proposed development. The physical scope is limited to the proposed site *on Plot No. Ruiru/Ruiru East Block 2/7379 At Kiambu County, Ruiru Kimbo Area, Off Thika-Nairobi Superhighway*: and the immediate environment as may be affected or may affect the proposed project. Any potential impacts (localized or delocalized) are also evaluated in line with EMCA 1999 and the Environmental (Impact Assessment) and Audit Regulation 2003. This report includes an assessment of impacts of the construction and operations/occupation on the proposed site and its environs.

1.6 Methodology

The methodology used in the study consisted of the following.

i) A site reconnaissance and visual survey to determine the baseline information of the project area
ii) Comparative study of the project with existing land uses in the neighborhood.
iii) Analysis of the project documents.
iv) Discussion with the proponent and his consultants
v) Assessment of the site to detail the various existing and likely impacts.
vi) Assessment of health and safety issues
vii) Seeking public views through questionnaires and interviews
viii) Proposal of mitigation measures to minimize any negative impacts.
ix) Preparation and submission of the report,

CHAPTER TWO: PROJECT DESCRIPTION

2.1 Nature of the project

The project constitutes one block apartments having 7 No. floors with ground floor level being of residential units 7 the other 6 floors each having 7 No. residential units. The all floors will each have 35 bedsitters and 14-bedroom units, totaling to 49 units. The 1-bedroom units will consist of a lounge, kitchen, bedroom and washroom. The rooftop consists of tank slab for placement of water tanks and a roofed area of iron sheets and timber. The shared facilities in these floors will be the corridors, and staircases.

Water will be provided by the county government of Kiambu. Liquid wastes shall be channeled to a septic tank, while solid wastes shall be managed by engaging the services of private waste and refuse handlers. The negative environmental impacts anticipated from the construction activities are minimal. They will be confined to the construction stage and within the limited boundary of the construction site.

2.2 The location of the project

The project is located in Ruiru Kimbo area in Ruiru municipality, Kiambu County. The site is approximately 12km, North of Nairobi CBD. It occupies an area of 0.0450acre piece of land. It is easily accessed through the Thika- Nairobi highway. The area in the neighborhood has been developed with similar development. The land reference number is ***Plot No. Ruiru/Ruiru East Block 2/7379 At Kiambu County, Ruiru Kimbo Area, Off Thika-Nairobi Superhighway***

The site is flat lying with a very gentle slope. The proposed site is rectangular in shape and surrounded by residential developments all around.

2.3 Justification of the proposed project

The project is justified on the basis that there is currently a shortage of high-end housing in Kenya, thus it's meant to provide decent and affordable housing facilities to the public.

2.4 Site ownership

The site is owned by the proponent, MARGARET WAIRIMU MBIRA as per the land registration documents and has a tittle deed for the same. The title number of the property is *Plot No. Ruiru/Ruiru East Block 2/7379 At Kiambu County, Ruiru Kimbo Area, Off Thika-Nairobi Superhighway* and the property is not encumbered or mortgaged in any way. The property is registered under the Registration of properties Act (Cap281).

2.5 Project description and design

The proposed project is a construction of one block apartments having 5 No. floors with ground floor level being of residential units 8 the other 4 floors each having 8 No. residential units. Waste water from the housing units will be managed through septic. Water for use will be sourced from the county government of Kiambu. The building has hired security agent that will ensure the safety of the tenants and their property.

2.6 Construction activities and inputs

2.6.1 Project input and activities

The development of the proposed project will utilize but not be limited to the following inputs:

i) **Land: -** Land is necessary for the anchorage of the apartments' foundation. The proponent has acquired land for the project.

ii) **Water: -** The project will depend on the county government of Kiambu.

iii) **Labour during the construction and operation of the project: -** It is the intention of the proponent that this labour is sourced from within the local community. This will be a direct economic benefit to them and will go far in creating a friendly relationship between the project and the neighboring community.

iv) **Input during Construction: -** The materials that shall be used include building sand, aggregates, natural stones; masonry dressed construction stones, roofing iron sheets and floor tiles. Other materials include timber concrete block for constructing selected internal and external pavements, precast units for drains, PVC pipes for sewer and water reticulation, wire mesh, and water tanks. Window casement and glasses, spades, pick axes, and jembes and a host of other tools will also be needed for the construction and ground preparation, there will

be earth movers, graders, and a concrete mixer will be set on the site for mixing concrete used in construction.

2.6.2 Project execution

The project will continue immediately NEMA's approval is obtained.

2.6.3 Existing technology

The construction will involve: earth work, foundation and building and construction involving mixing different types of building materials among other procedures.

The subsequent processes include:

i) Clearing of the construction site of debris
ii) Assembling of the materials and machinery required for the construction activities
iii) Commencing the construction according to the laid-out plans including a boundary wall.
iv) Making the final touches on the finished units.
v) Connection to the necessary services such as sewer, electricity and water.
vi) Occupation of the facility

2.6.4 Construction Activities and Timetable

The construction activities shall continue from the time NEMA approves EIA project report. The construction activities shall begin with excavation of soil and rocks from the site. Materials from the excavations of the ground and foundation work will be re-used for earth works and landscaping. The site will then be filled with hardcore and murram then be compacted as other civil and engineering works shall follow as here on:

i) Normal excavation of soil and filling with hardcore
ii) Laying of foundation slab and walling
iii) Plastering and painting
iv) Landscaping
v) Storm water and drainage construction
vi) Laying of the pavement blocks
vii) Installation of electrical works

viii) Government inspection/occupation certificate and completion of works issued

ix) Beginning of occupation

2.7 Project implementation sequencing

2.7.1 Pre-construction stage: - The preconstruction activities will involve:

i) Plan preparation and seeking of the appropriate approvals from the relevant authorities.

ii) Appraisal of baseline condition to determine supply and demand for required infrastructural services.

iii) EIA project report preparation.

2.7.2 Construction stage: - This will involve the following:

i) Establishment of related works and all support infrastructures that are significant for the construction work: - This will involve the transportation of machinery and deployment of the workers to the construction site. The machinery will be used for transportation of materials from the sources to the site. It is important to note that light machinery will be used at this stage. The major machineries that will be used include: Mixers, Welding machines and transmission machines. The contractor will also mobilise human workforce to the site. Both casual (unskilled) and permanent (skilled) will be hired.

ii) Site Clearance: - This will involve clearing of the site of any debris and foreign materials.

iii) Acquisition and transportation of building materials: - The contractor shall source for materials for construction from the various available suppliers. Supply of materials will be a continuous activity throughout the project life since different materials will be needed at different phases of the construction. The materials that shall be used in the construction include among others building stones, sand, ballast, cement, timber, reinforced concrete frame, steel, bars, G.I pipes, PVC pipes, pavement blocks, concrete slabs, murram, hardcore, insulated electrical cables and timber among others.

iv) **Construction of the apartments: -** The engineering designs and site layout plans that have been approved shall be implemented. The setting will comply with the specifications set out by the client to the contractor under the supervision of qualified engineers. In accordance with the designs and the layout plans, the construction of the proposed project and associated infrastructure will begin immediately NEMA approves the project report. The contractor will then be supplied with all the approved documents including the EIA report.

v) **Excavation and land filling works:** - This is part of normal construction works.

vi) **Transportation of the construction wastes from the site for landscaping: -**This will involve getting rid of any debris material from the site.

vii) **Solid and liquid waste management:** - For solid waste it will be recycled and for unrecyclable waste designated zone will be set aside for collection of the solid waste before organization with private waste handlers for proper dispersal. While liquid waste like water will be sprinkled to the site to reduce air pollution by means of dust.

2.7.3 Occupation stage: - This stage shall involve running and managing the facility as per the laid down rules and procedures.

2.7.4 Decommissioning Phase: -Decommissioning refers to the final disposal of the project and associated materials at the expiry of the project life span. This is dealt with in chapter ten of this project report.

2.8 Products, by products and wastes

2.8.1 Products

The residential building will offer housing facilities.

2.8.2 By-Products

There are no byproducts associated with the project.

2.8.3Wastes

In major construction projects, some waste is usually generated at the project site. These wastes include; broken glasses, pieces of broken tiles, nails and pieces of broken wood. In this project the construction wastes will be minimal. The removal and disposal of such refuse and other related wastes comes in handy. The contractor will work hand in hand with private refuse handlers and the relevant authorities to facilitate waste handling and disposal from the site. The wastes will be disposed into the approved dumpsites.

2.8.4Air emissions

Relative air emission is expected during construction when dust will be emitted. It is recommended that watering be enforced to keep dust at minimal levels. The employees at the site shall also be provided with dust masks to protect them from dust emissions. Other sources of emissions will include smoke emissions from machinery.

2.8.5. Firefighting Systems

All floors will be protected by sprinklers designed in accordance with NFP. All areas will be protected with the exception of electrical equipment rooms, small washrooms and cupboards. Hose reels will be provided for the use of occupants in event of fire. Various protection systems including oil leak detection, local water leak detection, major water leak protection, water supply protection and high temperature alarms will be installed for critical installations and where required. A fire lane and security checks have also been incorporated in the design to cater for the emergencies around the building.

2.8.6. Water Services

Portable water for consumption will be sourced from the county government of Kiambu. This potable water will be stored in storage tanks located on the rooftop of the building. The connections from these tanks will be directed to serve potable water outlets throughout the building including wash hand basins, the tenants' wet stack, kitchens, etc. and cold water connections to MEP plant

2.8.7. Lighting Systems

Corridor and security lighting will be managed by a lighting control system comprising central controllers, area controllers, lighting control modules, occupation sensors, LED Lighting, multi sensors and software. Lighting will be dimmable and be under daylight and occupancy controls.

To save energy, provision is made for lighting controls with; daylight linked dimming, occupancy controls in spaces which are not continuously occupied including the car park, time and daylight sensor controls on external lighting, energy management, lamp management monitoring for failure and integration for control and monitoring of emergency lighting.

2.8.8. Safety and Security Systems

A fully automatic fire alarm system will be installed incorporating the functions of fire detection and alarm, voice alarm and emergency voice communication. The building will be provided with a distributed type Fire Alarm System comprising multiple alarm collection panels, linked into a high integrity data collection reporting to the building Fire Command Centre and repeater panels as agreed with the fire service. A CCTV camera system will be installed with fixed and cameras monitoring the main access points and final escape exits and additional key internal areas, including the car park, lift lobbies/communication corridors on each floor. The system will incorporate monitoring and recording facilities.

2.9 Waste management

The principle objective of waste management program is to minimize the pollution of the environment as well as to utilize the waste as a resource. This goal should be achieved in a way that is environmentally and financially sustainable.

2.9.1Solid waste management

The technologies for the management of the solid wastes will incorporate the collection of the waste from the source, transportation of the waste to the place of processing and treatment and final disposal.

The following waste management techniques shall be used in the different stages of the Project.

i) During construction: - Wastes at this stage shall be managed as follows:

- Express condition shall be put in the contract that before the contractor is issued with a completion certificate; he will clear the site of all debris and restore it to a state acceptable by the supervising architect and environmental consultant.
- Materials from excavation of the ground and foundation works shall be reused for earthworks and landscaping.
- Remnants from the construction materials will also be re-used in the construction and also for landscaping.

ii) During operation: The following methods will be used to manage wastes:

- **Used Paper: -**Used paper shall be thrown in designated dustbins labeled within the property area. The paper waste shall then be collected and kept in a central place pending disposal.
- **Empty Cans and Plastic Containers: -**These will be collected and stored in a designated area pending disposal to designated areas or awaiting interested parties for recycling.

iii) Decommissioning: -During this stage, the following shall be observed:

i) Wastes generated as a result of facility decommissioning activities will be characterized in compliance with standard waste management procedures.

ii) Disposal locations will be selected by the contractor and the local council based on the properties of the particular waste generated

iii) All buildings, machinery, equipment, structures and partitions that will not be used for other purposes shall be removed and reused or rather sold/given to scrap material dealers.

2.9.2 Effluent treatment

There shall be effluents from the civil works, workers and storm water drainage. It is envisaged that during construction stage, waste water that shall be discharged shall be sprinkled on the working areas to reduce dust generation by the construction machinery. Wastewater from the toilets and water points will be handled through the septic tank.

2.9.3 Project Budget

The project cost is Kshs 10,000,000 (Ten Million). The project will take approximately twelve months to complete after start operations.

CHAPTER THREE: STUDY AREA

3.1 Baseline Information and Environmental Settings

Introduction

The proposed project site lies within Ruiru Kimbo area, Ruiru Municipality in Kiambu County. Kiambu is one of the fast-growing counties in Kenya. The county has experienced rapid growth both in terms of population and physical expansion in the past decade. The physical area of Kiambu has been expanding tremendously due to rapid urbanization.

i) **Climatic conditions: -**

The climate is Semi-humid, with average annual Rainfall of between 800 and 1400mm. The rainfall pattern exhibited is a bi-modal distribution with the wet seasons in (March-May and October-December) long and short rains respectively. Temperatures are highest in the months January to March; the mean annual temperature of the area is 19° C (TAMS, 1980).

ii) **Drainage**

The major rivers that cross the area include seasonal streams. All these drain from the East and flow towards the Western direction.

iii) **Administrative Framework**

Ruiru Kimbo is a suburb of Nairobi composed of residential homes and high-end commercial shops and restaurants. Indeed, this has made the area to develop into a major commercial and economic area outside the Nairobi town.

iv) **Geology and Soils:** -

The geology of Kiambu County comprises of tertiary volcanic rocks, the most important being what is termed as Nairobi Stone. The Nairobi stone is a tertiary volcanic rock used extensively for building purposes. Soils resulting from tertiary volcanic rocks are dark reddish brown, well drained, friable and very calcareous. The soils in the study area are derived from volcanic rocks that gradually occur on levels between 1200 to 2000m.a.s.l. The general nature of the soil within the area ranges from shallow to red friable clays. The soils also support shrub vegetation and hence the area is zoned as medium potential and favorable for urban development.

i) **Socio-Economic Set Up: -** The project area boasts of a mixed kind of socio-economic activities ranging from institutional activities, recreational, residential, trading, and

transport. People in private business, schools, employees in private sector, public sector etc. as well as commercial activities. Land in the project area has been sub divided for residential purposes and public utilities.

3.2 Infrastructural Facilities

Due to rapid urbanization, provision of basic infrastructure for all has become an important concern of development planners in Kenya. Basic infrastructural services that have deteriorated due to such rapid increase in population include: Solid Waste Management (SWM) system; Water and Sewerage Systems; Drainage and flood protection; Roads and Rail; Mass transportation; Electric installations; and telecommunications. Greater environmental pollution, congestion and problems have been the result of under-provision of such basic services.

Ruiru Kimbo area is well served with good telecommunication and transport network such as road. It is centrally located to serve the Kenyan counties Kiambu and Nairobi. A bus station is within an easy walk.

i) **Energy sources: -** The project area gets its energy supply from the Kenya Power and Lighting Company (KPLC). The site in particular will not have difficulty accessing electricity, since there is a power transmission line.

Figure 1: Electricity transmission lines above the site. Source Field Work, 2020.

ii) **Transport and Communication: -** The major roads in the project area is Thika- Nairobi Highway. The area is well covered by mobile phone service providers.

iii) **Health: -** Health facilities serving the project area are located within the area, about a kilometer radius from the project site there is a health Centre. Some of the health centers include: Kihunguro, Ruiru medical facilities.

iv) **Educational Facilities:** - There are some of the educational facilities within close proximity to the site

3.3 Waste Management

Waste handling companies have been contracted by the residents of the area to handle their solid wastes. Liquid waste in the area is mostly managed through septic tank.

3.4 Waste Water Disposal

The proponent will connect the premises to septic tank that will hold the waste generated.

CHAPTER FOUR: POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

As a government policy enshrined in the Constitution of Kenya, every citizen has a right to clean and healthy environment. In return, every citizen has the obligations and responsibilities to undertake in order to ensure the state of Kenyan environment remains clean and healthy. This chapter covers all relevant laws and regulations pertaining to the project and their relevance towards ensuring a clean and healthy environment as well as sustainable project implementation mechanism. Kenya has a policy, legal, and administrative framework for environmental management. Under the framework, NEMA is responsible for ensuring that EIAs are carried out for new projects and Environmental audits on existing facilities as per EMCA, 1999. Otherwise, there are a number of policy and legal framework that have direct bearing on the construction and optimum operation of housing projects. They include the following:

4.1. Relevant national policies

National Policy	Relevance to the proposed project
The constitution of Kenya 2010 Constitution of Kenya, 2010 The Supreme Law of the Republic of Kenya was voted in a national referendum on 4 August 2010 and promulgated on 27 August 2010. As the benchmark for all legislation and regulatory frameworks in the country, the Constitution of Kenya acts as a regulator and supervisor of all development measures and project control device. In its preamble, the constitution demands maximum value to environment as a national heritage and	The Project Proponent has a right to carry out the project but within the Kenya's legal structures. While carrying out the project, the proponent should ensure that the right to a clean and healthy environment for all is upheld in all during the project schedule. The project proponent is entitled to a fair administrative decision making process from NEMA and other state organs.

unifier of all citizens that needs proper management for the benefits of the future generations. In Chapter 4 on the Bill of Rights, the Constitution of Kenya, 2010 gives every person a fundamental right to clean and healthy environment. In such section 1, of the article, it directs that such cleanliness and health must take into account protection, management, and conservation of environment and associated resources for the benefits of the future generations.	The project proponent will ensure that there is minimal disturbance of the existing environment. The project proponent must ensure that all the applicable provisions of the constitutions are adhered to.
Environment and development policy (Sessional Paper No.6 of 1999) The aim of this policy is to harmonize environmental and development goals so as to ensure sustainability. The paper provides comprehensive guidelines and strategies for government action regarding environment and development.	The proposed project has the objective of improving the economy through job creation and paying taxes to the county and central government. Sound measures have been put in the design of the project so that its implementation does not negatively affect the environment and the neighbours.
The National Environmental Action Plan (NEAP) The NEAP was a deliberate policy effort to integrate environmental considerations into the country's economic and social development. The integration process was to be achieved through a multi-sectoral approach to develop a	Issues of environmental integrity have been addressed by this project, which the proponent needs to abide by.

comprehensive framework to ensure that environmental management and conservation of natural resources are an integral part of societal decision making.	
The National bio-diversity strategy The overall objective of the National Bio-Diversity Strategy and Action Plan (NBSAP) Is to address the national and international undertakings which are elaborated upon in article 6 of the Convention on Biological Diversity (CBD) It is a national frame work of action to ensure that the present rate of biodiversity loss is reversed and the present levels of biological resources are maintained at sustainable levels for posterity. The general objectives of the strategy are to conserve the Kenya's biodiversity, to sustainably use its components, to fairly and equitably share the benefits arising from the utilization of biodiversity resources and to enhance the technical and scientific cooperation and exchange of information in support of biological conservation.	The design of the project has taken into consideration the interactions of man and the biological environment. To ensure that nothing is overlooked, an EIA study has been done to inform the modalities of such interactions.

4.2. Legal framework

Act	Cap	Relevance to the proposed project
The water Act This prohibits the pollution of water. Part ii, section 3 states" every water resource is hereby vested in the state subject to any rights of user granted by or under the Act of any law. In addition the right to any use of water from any water resources is vested in the minister for water Resources Development and Management except to the extent that it is alienated by or under the act or any other written law (Section 5). Consequently a water permit must be obtained before using any water resource.	**2016**	Waste disposal facility should be well designed. The development should not pollute the neighbouring river. The water from the river should not be used in any way without the necessary permit from Water Resource Management Authority, and the same agency should be consulted before any construction is erected in, above or under a river as provided in law.
The Physical Planning Act of 1996 Part IV No 36 of the act requires that, "If in connection with a development application a local authority is of the opinion that proposals for industrial location, dumping sites, sewerage treatment quarries or any other development activities will have injurious impact on the environment the applicant shall be required to submit together with the application an environmental impact assessment report."	**286**	The project must be implemented based on the provisions of this Act, Enforceable by the Kiambu County council with respect to this project.
Environment Management and Coordination Act, 1999 This is an act of parliament, which provides for the establishment of an appropriate legal and institutional framework for the management of the environment and for matters connected therewith and incidental thereto. Section 58(1) states that notwithstanding any approval, permit		The proposed project falls under the second schedule in section 58, "any activity out of character with its surrounding" since it is likely to cause substantial impact to the environment in areas such as waste disposal,

or license granted under this act or any other law in force in Kenya, any person being a proponent of a project shall, before carrying out, executing, or conducting or causing to be financed, commenced, proceeded with, carried out, executed or conducted by another person any undertaking specified in the second schedule to this act submit an Environmental impact assessment report.		sustainable resource use, ecosystem's maintenance, social environment, land use and water conservation.
Environmental Impact Assessment and Audit Regulations 2003. These regulations stipulate how an EIA report should be done and specify all the requirements. It highlights stages to be followed, information to be made available, role of every stakeholder and rules to observe during the whole EIA project report making process		The proposed project shall be constructed and operated based on these regulations. It should also be maintained and guided by the same regulations and an environmental audit study will be done periodically to monitor compliance with the set environmental standards.
Air Quality Regulations 2014 These regulations provide for the prevention, control and abatement of air pollution to ensure clean and healthy ambient air. Section 33 of the act stipulates that No person operating construction equipment or handling construction material shall allow emission of particulate matter so as to adversely affect the limits set out in the First schedule.		The regulations will be adhered to and the contractor shall ensure that air pollution is minimised to the lowest possible level.
Waste Management Regulations 2006 This regulation gives guidelines on both operational and administrative activities that are used in handling, packaging, treatment, condition,		Since the proposed project will generate both solid and liquid wastes during construction, operation, and decommissioning phase, this

storage and disposal of waste and is implemented by NEMA. It prohibits anyone from disposing any waste on any part of the environment except in designated waste receptacle or facility provided by the relevant local authority which may be legitimate dump sites or landfills Section 3 of these regulations stipulate that any person whose activities generates waste has an obligation to ensure that such waste is transferred to a person who is licensed to transport and dispose of such waste in a designated waste disposal facility.		act provides for the waste generator to be responsible for collection, segregation at source and proper disposal of their wastes.
Noise and Excessive Vibrations Pollution Control Regulations 2009 This regulation prohibits any person from causing unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. Part 11 section 6 (1) states that no person shall cause noise from any source which exceeds any sound level as set out in the First Schedule of the regulations. It gives standards for maximum permissible noise levels for construction sites, mines and quarries. It also gives maximum permissible noise levels for silent zones, places of worship, residential (indoor/outdoor), mixed residential; and commercial.		The project shall be implemented based on the provisions of these regulations.

Water Quality Management Regulations, 2006 These regulations were drawn under section 147 of the Environmental Management and Coordination Act 1999. In accordance with the regulations, every person shall refrain from acts that could directly or indirectly cause immediate or subsequent water pollution and no one should throw or cause to flow into water resources any materials such as to contaminate the water. The regulation also provides for protection of springs, streams and other water sources from pollution.		The proposed project will operate under this regulation. The proponent shall ensure that there is no pollution of the river and or any other water body.
Conservation Of Biological Diversity And Resources, Access To Genetic Resources And Benefit Sharing) Regulations, 2006 Part II of Regulations, section 4 states that no person shall engage in any activity that may have adverse impacts on ecosystems, lead to introduction of exotic species or lead to unsustainable use of natural resources without an EIA license. The regulation puts in place measures to control and regulate access and utilization of biological diversity that include among others banning and restricting access to threatened species for regeneration purposes. It also provides for protection of land, sea, Lake or river declared to be a protected natural environmental system in accordance to section 54 of EMCA, 1999.		The proposed project will uphold this regulation and ensure the conservation of biodiversity where possible.

The Penal Code The chapter on "offences against health and convenience" contained in the penal code enacted in 1930 strictly prohibits the release of foul air into the environment which affects the health of the other person. Any person who voluntarily violates the atmosphere at any place to make it noxious to the health of persons in general, dwelling or carrying of business in the neighbourhood or passing along public ways is guilty of a misdemeanour, i.e. imprisonment not exceeding two years with no option of fine.	**63**	Waste disposal and other project related activities would have to be done in keeping with the provision of this law.
County Government Act This actoutlines county governments' powers, functions and responsibilities to deliver services and the connected purposes. Section 116 (1) of the act stipulates that A county government and its agencies shall have an obligation to deliver services within its designated area of jurisdiction. (2) A county shall deliver services while observing the principles of equity, efficiency, accessibility, non-discrimination, and transparency, accountability, sharing of data and information, and subsidiary.	**265**	The county government of Kiambu run all services within the project area and their rules shall be adhered to.
The Public Health Act This act has provisions for maintaining and securing health. It defines what environmental nuisance is.	**242**	Various health hazards are likely to emanate from the proposed project's activities such as workplace accidents, air, and water and land

		pollution. There is therefore need to integrate health issues to the project to ensure healthy environment.
Urban and Cities Act No 13 of 2011 The Act came into function with regard to Article 184 of the Constitution providing regulations on the classification, governance and management of urban areas and cities and further providing the criteria of establishing urban areas. Part III of the Act gives the regulations and functions of every city or municipality with regard to integrated development plans, which shall include but not limited to environmental plans and disaster preparedness, within the area of jurisdiction in achieving objects of devolved governments under section 174 of the constitution while maintaining the socio-economic rights of the people. Moreover, in the first schedule, the Act enlists the services the services that the any municipality/ City shall provide to its residents which include but not limited to traffic control and parking, water and sanitation, refuse collection, solid waste management, pollution abatement services among others.		The Kiambu County Planning and Environment Department have been actively involved in the planning of this development as from its initial stages.

The Environment and Land Court Act, 2011 This Act is in place to give effect to Article 162(2) (*b*) of the Constitution; to establish a superior court to hear and determine disputes relating to the environment and the use and occupation of, and title to, land, and to make provision for its jurisdiction functions and powers, and for connected purposes.		This Act shall of great essence to the proponent, public, interested or affected party that may want to litigate against the development on settlement issues, location of project or even effects of the project to the public
The National Construction Authority Act No.14 of 2011	**14**	14. Co-option of members and establishment of Committees (1) The Board may co-opt such experts and consultants as may be necessary to assist in the discharge of its functions. (2) The Board may establish such Committees as may be necessary for the performance of its functions and may, subject
Work Injury Benefits Act (WIBA) 2007	**10**	10. (1) An employee who is involved in an accident resulting in the employee's disablement or death is subject to the provisions of this Act, and entitled to the benefits provided for under this Act. (2) An employer is liable to pay compensation in accordance with the provisions of this Act to

		an employee injured while at work. (3) An employee is not entitled to compensation if an accident, not resulting in serious disablement or death, is caused by the deliberate and willful misconduct of the employee. 45.(1) An employer shall provide and maintain such appliances and services for the rendering of first aid to his employees in case of any accident as may be prescribed in any other written law in respect of the trade or business in which the employer is engaged.
Occupational Safety and Health Act (OSHA) 2007	**50**	**50.(1)** An occupier shall ensure that effective provision is made for securing and maintaining sufficient and suitable lighting, whether natural or artificial, in every part of his workplace in which persons are working or passing. **52. (1)** Sufficient and suitable sanitary conveniences for the persons employed in the workplace shall be provided, maintained and kept clean, and effective provision shall be made for lighting the conveniences; and,

		where persons of both sexes are or are intended to be employed (except in the
Grass Fires Act (CAP 327)	**6**	6. Burning of vegetation by employees (1) No employee of the owner or occupier of any land shall burn any vegetation thereon except with the consent and under the personal direction of such owner or occupier or such person as may be authorized by such owner or occupier.
Registration of Titles Act Cap 281	**60**	60. (1) Where it appears to the satisfaction of the registrar that a grant, certificate of title or other instrument has been issued in error, or contains any misdescription of land or of boundaries, or that an entry or endorsement has been made in error on any grant, certificate of title or other instrument, or that a grant, certificate, instrument, entry or endorsement has been fraudulently or wrongfully obtained, or that a grant, certificate or instrument is fraudulently or

		wrongfully retained, he may summon the person to whom the grant, certificate or instrument has been so issued, or by whom it has been obtained or is retained, to deliver it up for the purpose of being corrected.
Land Titles Act Cap 282	**22**	22. Upon the determination of the right of any proprietor, and, if the Recorder of Titles should so think fit, before the issue of the certificate of title, the surveyor appointed under section 10 or his assistant shall, if and when directed by the Recorder of Titles, demark and delimit the boundaries of the land comprised in the estate upon a map or plan, and he shall determine, place or cause to be placed upon the land boundary marks showing the demarcation and delimitation thereof, such boundary marks to be so placed at the expense of the Government and maintained and repaired at the joint or proportionate expense of the proprietor of the land and of the proprietors of land contiguous thereto, and any proprietor

		thereafter altering or causing to be altered whether temporarily or otherwise those boundary marks without the leave in writing of the Recorder of Titles or other officer duly authorized in that behalf shall be guilty of an offence and subject to penalties as hereinafter provided.

:

4.3. Administrative and Institutional Framework

There are several institutional arrangements responsible for development control in different sectors. In this project, some of the institutions whose mandates fall within the assignment include:

I. National Environmental Management Authority (NEMA)

Established under EMCA, 1999, NEMA acts as the lead agency in regulating development in relations to conservation, utilization, and management of environmental resources in the country.

The objects and purpose of the NEMA are stipulated in Section 9(1) of EMCA, 1999 that charges the Authority with the responsibility of general supervision and co-ordination of all matters relating to the environment and representation of government in the implementation of all policies and regulations relating to the environment.

Relevance to the Project

NEMA is responsible for conditional issuance of Environmental Impact Assessment license. Besides, the authority has the responsibility to follow up on project development to ensure compliance to conditions set out in the license, and it has the power to revoke EIA license upon when convinced that project component violates the provisions of the license.

II. County Government Kiambu

Constituted under the First Schedule of the CoK, 2010, the county government Kiambu is responsible for initiating local and development projects within its jurisdiction. Some of the roles of the Kiambu government include the provision of county planning needs in the development arena; provision of health services; and provision of water and sanitation service. Similarly, Kiambu County government is responsible for development control in the local sub-counties, regulation of housing development through control and supervision measures; and maintenance of an inspectorate department for regulation and supervision of all development projects in the county.

Relevance to the Project

The County government of Kiambu is the custodian of the county's physical development plans. It must approve the development projects through the department of physical planning and housing development. Also Kiambu County government is responsible for regulation and

inspection of development projects. Compliance to the provision of the licenses ensures smooth implementation for the project.

III. Ministry of Health

This is the agency charged with the responsibility of ensuring adequate health and sanitation programs in the country on behalf of the national government. In the water and sanitation services, the ministry is responsibility for supervising the development of health and sanitation policies for effective management of wastes. The ministry is also responsible for provision of community health service, promotion of healthy behaviors, reproductive health campaigns, and ensuring food hygiene among other functions.

Relevance to the Project

The county government institutions in collaboration with, the ministry provide relevant advice on the location of water and sewerage treatment systems in the county. Consulting the national government before implementation of the project gives the project proponent a preamble of the expected systems of water and sewerage services provision in the county.

IV. Ministry of Labour and Social Security Services

As a government agency, this ministry seeks to enforce labor laws, maintain industrial peace, industrial training and promote safety and health of employees. The Ministry also has a responsibility to develop and coordinate implementation of policies and strategies for human resource development, micro, and small enterprise sector and productivity improvement.

Relevance to the Project

The ministry is responsible for implementation and enforcement of occupational, health, labor, and social service policies in the country.

Proponent's compliances to the safety, social security, and welfare of the persons employed in the project implementation will be supervised by the ministry of labor and social security services.

The department of occupational health and safety, the ministry will supervise the occupational health and safety policies set out by contractors the ensure conformity with the country's demands and expectations.

V. Water Resource Authority

This is an institution established under the Water Act 2016 as the principle authority of the government on all matters related to water utilization, resources, management and distribution. Part II, section 18, of the Water Act 2002 provides for national monitoring and information system on water resources. Additionally, sub-section 3 allows the Water Resources Management Authority (WRA) to demand from any person or institution, specified information, documents, samples or materials on water resources.

Relevance to the project

The proponent and all the allied stakeholders to the project shall ensure proper water use, management and conservation. In the event of borehole drilling WRA shall be consulted by the project hydro geologists for the purpose of attaining permits for borehole sinking. Besides, specific records may require to be kept by a facility operator and the information thereof furnished to the Authority

CHAPTER FIVE: ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1. Description of the existing and anticipated impacts

i. Anticipated impacts: -

The impacts of the proposed project on the environmental elements are both positive and negative. The magnitude of each impact is described in terms of being significant, minor or permanent, short-term or long term, specific (localized) or widespread, reversible or irreversible. Most of the impacts have been addressed in the proactive design of the project and other mitigations can only be guaranteed through active and responsible management committed to the propositions of the environmental management plan.

5.2. Positive impacts

5.2.1. Construction phase

- **Employment Creation**

  With the implementation of the project, there will be employment opportunities for not only those who will be providing manual work, but also those providing professional works and consultancy.

- **Increased value of land**

The proposed development is bound to increase the value of the land as a result of the infrastructural development and the demand for the proposed facilities. The apartments will be constructed in a way that appeals not only to the local investors, but also international. Hence, the apartments will raise the profile of Ruiru Kimbo area with regard to the resident it will attract.

- **Aesthetic value**

The proposed development will enhance the site aesthetic value. The designs of the proposed facilities will ensure visual attractiveness which will thus add beauty to the site. The proponent has put in place, elaborate mechanism to improve the vegetative landscape of the area after construction.

- **Increase in the number of residential units**

The intended construction of the proposed apartment will lead to an increase in the stock of high-quality apartment in Ruiru Kimbo area and environs.

- **Creation of business opportunities**

As a result of the proposed project a large number of people (skilled and unskilled) will be required during the construction stage. The construction will provide a ready market for various goods and services, leading to several business opportunities for small-scale traders such as food vendors around the construction site.

- **Improved land utilization**

The development of proposed site is expected to lead to better (maximized) utilization of land, per square metre of built up area.

- **Market for Building Materials**

The project will require supply of large quantities of building materials most of which will be sourced locally in and around Ruiru Kimbo area and Nairobi town. This will provide a ready market for building materials.

5.2.2. Operational phase

- **Revenue to local and national Government**

The development will provide revenue both to the local and the National Governments through payment of relevant taxes, rates and other levies after revaluation.

- **Employment Creation**

Employment will be generated with a number of people being employed at the project site including security personnel, ordinary labourers' cleaners and gardeners. Some of the amenities with prospects for employment during the operational phase is; business shops, and chemistry.

- **Improvements in security**

The occupation of the apartments and the employment of 24-hour security officers for the premises will improve security in the area particularly at night.

5.2.3. Decommissioning phase

- **Rehabilitation**

After the decommissioning of the project, rehabilitation of the project site will be carried out to restore the site to its original status. This will include replacement of the soil and re-vegetation that will lead to improved visual quality of the area.

- **Employment Creation**

Employment opportunities will be created for the demolition staff as well as those involved in loading, transportation and unloading of the demolished materials.

- **Recycling of usable materials**

Not all the demolished materials will go to waste as some may be recycled for alternative uses.

On the basis of information gathered during both the desktop and field study, the potential environmental impacts of the proposed project are as tabulated below.

5.3. Negative Impacts and Mitigation

5.3.1. Construction phase

i. Soil erosion: -

In this project, soil erosion will be a major environmental issue or concern since there will be major excavation, and the site is sloppy towards the adjacent River. Consequently, there are likely to be cases of soil disturbances, exposure, and loosening to the agents of erosion.

Potential mitigation measures

- Avoid unnecessary movement of soil materials from the site
- Holding of the site to prevent excavated soil form filing the river
- Provide soil conservation structures on the areas prone to soil erosion mostly to reduce impact by the run-off.
- Control construction activities especially during rainy conditions.
- Resurface (pave) open areas on completion of the project.
- Provision of suitable storm water drainage channels to effectively discharge water safely. Such channels need to be regularly maintained. Point discharges which have pronounced effect to soil erosion shall be avoided
- Standard landscaping will be conducted after project completion to maximally control any possible chance of soil movement.
- Avoid clearing of the vegetation along the stream to act as soil erosion control agents.

ii. Water Use and Management: -

The construction activities will require large quantities of water that will be supplied by near-by county government. Water will be used mainly for concrete mixing, curing, sanitary, and washing purposes

Potential mitigation measures

- Provision of notices and information signs within the project to notify on the needs to conserve water resource.
- Encouragement of water re-use/recycling during construction
- Avoid using the water from the stream for the construction purposes unless there is adequate permit from WRA.

iii. Solidand liquid waste Generation

Solid waste will be generated during excavation of the site for foundation works and landscaping. Additionally, the used materials used as package of construction material will form solid waste. Liquid wastes will be generated from the cleaned surfaces, paints, and lavatory

Potential mitigation measures

- The contractor and proponent shall work hand in hand with private refuse handlers and local authorities to facilitate sound waste management.
- The wastes shall be properly segregated and separated to encourage recycling of some useful waste materials.
- Use of an integrated solid waste management system through a hierarchy options: source reduction, recycling, composting and refuse. This will facilitate handling during occupation.
- Any waste water arising from construction should be sprinkled to the site and reduce dust, except oil and paints, which should be disposed of as provided under the user instruction manual.

iv. Pollution

- **Dust pollution**

During construction, the project will generate substantial amount of dust at the construction site and its surrounding area. The sources of dust will include excavation and levelling works, and transport vehicles delivering building materials.

Potential mitigation measures

- Provision of full protective gear for workers. Workers shall also be sensitized on hazards encountered in such work environment and shall undergo regular health check-ups.
- Control over areas generating dust particles through regular cleaning or sprinkling of water to suppress dust.
- The number of construction equipment operating simultaneously shall be minimized through efficient management practices.
- Vehicle idling time shall be minimized.
- The contractor shall carry out routine maintenance of vehicles and other machinery as per the manufacture's specifications to ensure minimum emission of NO2 and SO2.
- Maximize the use of manual labor and hand tools.
- Avoid spillage of loose soil to the road where it will be disturbed and blown away by traffic.
- Sensitize drivers to avoid off road driving.
- Stockpiles of sand and soil should be covered or surrounded with wind breaks
- Trucks hauling dirt and debris should be covered to reduce spillage on to paved roads surface.
- Expedite construction so that it can take the shortest time possible.
- Install dust protective nets around the site to cushion the nearby residents from dust pollution.
- Preserve the trees around the site to act as dust obstructers.
- Provide adequate signage on the site for users and workers to take precautionary measures against dust infection.

- **Noise Pollution**

The construction works, delivery of building materials by heavy trucks and the use of machines/equipment such as bulldozers, generators, metal grinders and concrete mixers will contribute to high levels of noise within the construction site and the surrounding area. Elevated noise levels will affect project workers, the nearby residents, passers-by and other persons within the vicinity of the project site.

Potential mitigation measures

- truck drivers to switch off vehicle engines while offloading materials
- avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as churches, schools and hospitals
- construction machinery shall be kept in good condition to reduce noise generation
- all generators and heavy-duty equipment be insulated or placed in enclosures to minimize ambient noise levels
- Provide the workers with sound protective gears to cushion them from noise pollution
- Provide sign on the site for purposes of informing the site users, and workers in case of previous health problem with relation to hearing.

v. Fuel Consumption, Oil leaks and spills:

The project activities will lead to an increase in consumption of fossil fuels manly diesel to run transport vehicles, construction machinery and cars for construction management staff and consultants. These are non-renewable resources and should be used economically and efficiently**.**

Potential mitigation measures

- Strict avoidance of oil grease spills and leakages and
- Construction of oil interceptors if need be.
- Oil product and materials shall be stored appropriately

vi. Visual Intrusion: -

Visual impacts will occur during earthworks for the foundation of the project.

Potential mitigation measures

- All solid wastes and debris shall be cleared on the completion of the work

- On completion of all works, the worked area shall be restored through backfilling, leveling and planting of vegetation.
- Fence the site using construction nets and iron sheets to prevent visual intrusion.

vii. Occupational Health and Safety (OHS): -

During the proposed works, there may be increased hazards to health and safety such as dust, air, and noise pollution. The workforce and general public involved would be more subjected to these environmental hazards and disturbances. Foods for the construction workforce are usually provided by itinerant individuals most of who operate without license. This can compromise health of the workers especially if such foodstuffs are prepared unhygienically.

Potential mitigation measures

- Sanitary facilities shall be provided and cleanliness shall be ensured as per set standards.
- A fully equipped first aid kit shall be provided and shall be managed by qualified persons.
- Adherence to environmental health and safety regulations.
- Individual food vendors preparing food for the workers at the site shall be controlled and monitored to ensure that food is hygienically prepared.
- Ensure consistently good water quality through regular water analysis to ascertain compliance to public health standards.

viii. Construction and Safety: -

As provided for in the factories and other places of work Act; the safety of those in the workplace should be given the weight it deserves. The following will be given priority.

- Proper personal protective equipment i.e. safety boots, helmet, goggles, respiratory equipment and gloves shall be used at all times on the site during construction or as condition warrant and workers trained on the proper use of tools
- Prior to the start of the construction, all areas shall be inspected for the presence of potentially hazardous substances.

- Contractors and managers shall use barriers and guards as necessary to protect employees and visitors from physical hazards. Danger warning or CAUTION will be put at strategic places.
- The contractor and management shall adhere to the provisions of environmental health and safety plan (EHS).

5.3.2. Operational Phase

i. Sewage and Effluent: -

Effluent/sewage resulting from sanitary facilities and wastewater from washrooms is of significant concern with respect to the environment if it is untreated. It will be handled by draining effectively into the Septic. Sound sanitation will be ensured to influence prevention of outbreak of diseases detrimental for the general health of the workers, visitors and the general public.

Potential mitigation measures

The proponent will ensure that there are adequate means for handling the large quantities of sewage generated by the units being directed to the septic tank.

ii. Surface drainage

The drainage of the general site is necessary to enhance effective flow of the much-anticipated surface run-off from impermeable areas within the site.

Potential mitigation measures

- Drainage channels shall be installed in all areas that generate or receive surface water and be connected to the existing storm water drainage channel. The channels shall be covered with gratings or other suitably approved materials to prevent occurrence of accidents and dirt entry that may compromise flow of run-off.
- Paving of the sidewalks, parking and other open areas shall be done using pervious materials i.e. concrete blocks to encourage water percolation thus reducing run-off volume.

- Storm water generated from roof catchments shall be harvested, stored and made use of in various activities e.g. general cleaning and vegetation watering thus reducing run-off and pressure on water supply.

iii. Solid Waste

The proposed activities will generate related solid wastes. If solid waste is not removed promptly away from the generation points it accumulates in to large heaps harboring rats, flies etc. which transmits disease not to mention bad odors on decomposition.

- Provision of bins, one for organic matters and the other mineral matter. These will be of approved type, size and color to effect waste separation and disposal. The bins shall be kept in a good condition and sanitarily cleaned by frequent washing and disinfecting.

iv. Security: -

Security of the site and those working and living within is of utmost significance. The house-dwellers within the facility must be assured of their security at all times.

Potential mitigation measures

- Strategic installation of lighting as well as security alarms and backup systems
- Hiring security guards within the property to provide security in a 24-hour basis.
- The site shall be fenced.

v. Water Use

During the operational phase, the various activities will require large quantities of water, i.e. for cleaning, sanitary purposes etc.

Potential mitigation measures

- On occupation of the apartments, metering per unit of water shall be done and conservation be promoted.
- Installation of water conserving taps that turn-off automatically when water is not in use.
- any water leaks through damaged pipes and faulty taps will be fixed promptly by qualified staff

vi. Fire hazards: -

The operations that lead to fire outbreaks include poor handling of electricity systems, faulty electrical equipment, carelessness etc. It is important to consider the issue of fire by bringing in the element of preparedness. In this regard, the design of the project has provided and recommended implementation of firefighting measures and control facilities. These include the following:

- All fire control and fighting facilities shall be installed following countygovernment fire masters requirements and approval.
- The dwellers will be encouraged to be aware of requisite actions basic first aid to take in case of fire outbreaks.
- The proponent will ensure that all firefighting equipment are strategically positioned, regularly maintained and serviced
- There shall be provided fire hazard signs such as no smoking signs, directions to exit in case of any fire incidence; and emergency contact numbers shall be provided.

vii. Energy demand and conservation: -

Energy conservation involves optimum use of fossil fuels, electrical appliances (equipment) lighting systems and other electric machinery and equipment as used for different purposes. It also includes the use of renewable energy sources.

Potential mitigation measures

a) Electrical appliances: - All the appliances shall be switched off when not in use. Operations of electrical equipment's shall be optimized so that energy is not wasted.

b) Lighting

- Energy conserving electrical lamps use shall be encouraged.
- All lights will be put off when not in use
- An alternatives energy source, a generator can be installed.

viii. Accident prevention: -

The following rules will be observed to avoid accidents both during construction and occupation of the building.

- Ensure that the operational manuals are available and accessible for every equipment /machinery
- Properly maintain all machinery and equipment to prevent premature failure or possible accidents
- All electrical equipment and machinery shall be properly grounded
- Only properly trained employees to operate equipment or machinery and proper instructions in their safe operation shall be provided.

CHAPTER SIX: PROJECT ALTERNATIVES

6.1 The proposed alternatives

This EIA project report has been prepared for submission to NEMA based on sound desktop and field studies made by the EIA team. The findings and recommendations are based on the proposed site materials and the proposed technologies to be used in implementation of the proposed project.

6.2 Alternatives to site

A change of site alternative will require that the project be implemented at an alternative site other than the proposed site. Change of site will mean the proponent has to purchase an alternative piece of land. The result will be an increase in time and resources required to complete the transactions. The unpredictability of financial resources and the lengthy duration required in acquiring and completing official transaction on it may presents great challenges to having an alternative site for this project. Proposed site was chosen because the proponent already owns the plot. Besides, there is no guarantee that an appropriate land will be available at a reasonable cost within the project area.

6.3 Alternative to technology

The proponent should consider installing solar panels so that solar energy is also used as an alternative source of power during the project operation.

6.4 No project alternatives

This means that the status quo remains and the proponent will have to contend with the land being idle. This may lead to underutilization of the land and the proponent missing out on the good returns from the housing sector being experienced presently.

6.5 Comparison of alternatives

The proposed project is the best alternative since it will lessen the housing shortage being experienced in the country, lead to revenue for the proponent and the government, improvement in service delivery and will create employment opportunities for more people.

CHAPTER SEVEN: ENVIRONMENTAL MANAGEMENT PLAN (EMP)

7.1 Significance of EMP

Integrating environmental issues in business management, such as those related to real estate development is that it increases efficiency while enhancing the project proponent financial and environmental management. These issues, which are normally of financial concern, are: costs, product quality, investments, level of productivity and planning.

Environmental planning and management as a concept seeks to improve and protect environmental quality for both the project site and the neighborhood through segregation of activities that are environmentally incompatible. Environmental planning and management integrates land use structure, social systems, regulatory law, environmental awareness and ethics.

Environmental management plan (EMP) for development projects such as the proposed residential apartment complex development is aimed at providing a logical framework within which identified negative environmental impacts can be mitigated and monitored. In addition, EMP assigns responsibilities for action to various actors, and provides time frame within which mitigation measures can be done.

EMP is a vital output for an environmental impact assessment as it provides a checklist for project monitoring and evaluation. A number of mitigation measures are already incorporated into the project design.

The EMP outlined in Table 8-1 has addressed the identified potential negative impacts and mitigation measures for the proposed residential development.

7.2 Environmental monitoring and audits

Environmental monitoring and audits are essential in Projects life span as they are conducted to establish if project implementation has complied with set environmental management standards for Kenya as spelt out in EMCA 1999 and the Environmental Impact

Assessment and Audit Regulations 2003. In this Project, environmental monitoring and audit will be conducted to ensure that identified potential negative impacts are mitigated during the project's life span.

Table 7.1:**ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN – CONSTRUCTION AND OPERATION PHASES**

IMPACT	PROJECT PHASE	PROPOSED MITIGATION	RESPONSIBILITY	MEANS	ESTIMATED BUDGET
Energy Resources	Construction	Ensure electrical equipment appliances and lights are switched off when not in use Design to provide for adequate natural lighting	Contractor	Inspections	-
	Occupation	- Install energy saving bulbs at all lighting points instead of bulbs - Install solar system to complement heating and lightning. - Encourage use of natural lighting during the day - Sensitizing guests to use energy efficiently by switching off when not in use - Monitor energy use by setting targets for efficient energy use	Proponent/ Property manager	Inspection/ observation/ records	40,000
Changes in Land use	Construction	- Ensure compliance with existing planning policy. - Landscaping and introduction of vegetation	Contractor	Inspections	20,000
	Occupation	- Maintenance of the landscaped gardens conservation and	Contractor	Inspections	5,000 Monthly

		management of vegetation and gardens			
Changes in hydrology impended drainage	construction	- Proper installation of drainage structures - Install cascades to break the impact of water flowing in the drains - Ensure efficiency of drainage structures through proper design - Provide gratings to the drainage channels	Contractor	Inspection	30,000
Soil disturbances	Construction	- Control earthworks - Install drainage structure properly - Compact loose soil - Ensure management of excavation activities - Control activities during rainy conditions - Provide soil erosion control structures on the steep side during construction	Contractor	Inspection	25,000
	Occupation	- Ensure maintenance and efficiency of erosion control measures.	Contractor	Inspection	10,000
Noise pollution	Construction	- Sensitize drivers of machinery on effects of noise	Contractor	Inspection/ Observation	15,000

		- Maintain plant equipment - Construction time to be controlled today time only. - Workers in the vicinity of high level noise to wear PPE			
Oil pollution	Construction	- Proper storage, handling and disposal of oil and oil wastes - Maintain plant and equipment to avoid leaks - Maintenance or construction vehicles should be carried out in the contractors yard off the site	Contractor	Inspection	-
Water Resources	Construction	- Management of water usage. Avoid unnecessary wastage - Construct water reservoirs and rain water harvesting systems - Supplement companies with water from other sources with necessary approvals - Recycling of water where possible - Install water conserving taps that turn off automatically when not in use	Contractor	Inspection / Observation	50,000
	Occupation	- Make use of roof catchment to provide water for general use	Proponent	Inspection / Observation	30,000

Road safety	Construction	- Enforce speed limits for vehicles especially along roads leading to the site - Provide bill boards at the site/entrance to notify motorists about the development - Construct safe & un-obstructed acceleration and deceleration	Contractor	Observation	10,000
Public Health &occupational	Construction	- Train staff/workers on occupational health and safety - Provide full PPE and workmen's compensation cover in addition to the right tools and operational instructions & manual - Adopt sound waste management system to ensure proper solid waste disposal and collection facilities - Adopt sound housekeeping practices - Ensure use of standard construction materials. Avoid undesirable substandard hazardous materials during construction and maintenance. - Ensure machinery & Equipment servicing and maintenance as per schedule	Contractor/ Supervisor/ Foreman	Observation	10,000

		- Post strategically the factory and other places of work Act abstract & provide material safety data sheets - Post clear warning sign e.g. No unauthorized use of machines. Ensure there are guards on moving parts. - Provide Ensure PPE and train staff on its use			
	Occupation	- Sensitize residents on environmental management	Proponent/ Property Manager	Observation	5,000
Vegetation	Construction	- Plant trees where vegetation is removed - Landscaping and planting all disturbed areas	Contractor	Observation / Inspection	-
	Occupation	- Maintenance & Watering	Proponent/ Contractor	Inspection/ Observation	30,000
Internal Audits	Construction & Occupation	- Monitoring will involve measurements, observations evaluations assessments and changes in waste quantities, noise levels contractor safety etc.	Proponent contractor	Inspection	30,000 p.a
Fire safety & preparedness	Construction	- Install fire equipment as provided in the report	Contractor	Observation	30,000

	Occupation	- Conduct training on firefighting evacuation and emergency response. - Adopt effective emergency response plan - Maintain service firefighting machinery regularly - Provide emergency numbers at strategic points - Sensitize the residents on the fire risks i.e. conduct regular fire drills	Proponent	Observation	30,000
Waste Management	Construction &Occupation	- Strictly abide by the provisions of the water Act & the Environmental Management(Water Quality)Regulation: Waste Management Regulations - Follow the prevailing NEMA regulations on waste collection, storage, transportation, and disposal - Waste management installations (i.e. sewer) be isolated from the public water pipes to avoid contamination of the later - Incorporate suitable facilities for collection, segregation, and safe	Contractor/ Proponent	Observation	10,000 p.m.

		disposal of solid waste. Provide a waste collection center and appropriately labelled bins preferably colour code for various categories of waste into organic (biodegradable) food remains, plastics, glass, polythenes, and metal wood. Waste should be reduced and segregated at source and suitable bins properly labelled to facilitated recycling and/or sound disposal - Dust bines cubicles must be protected from animals and rain - Bins should be regularly cleaned and disinfected - Provide possibilities for waste recycling options- in-house and off site - Identify suitable solid waste disposal arrangement. - Ensure a continuous review of waste management procedures with changing technology and regulatory changes			
Visual Intrusion	Construction & Occupation	- Construct perimeter fence if possible	Contractor	Inspection/ Maintenance	40,000 p. m

		- Retain existing trees in areas not affected by the works if any - Restore the site after completion by removal of all waste and landscaping and introduction of suitable vegetation - Ensure compatibility of design and decoration so as to make the development attractive to the eye			

CHAPTER EIGHT: PUBLIC CONSULTATION

8.1 Public Participation

Public participation basically involves encouragement of the public to express their views. Essentially, it seeks to ensure that due consideration is given to public values, concerns and preferences when decisions are made.

Consultation and public participation for this proposed project was carried out as detailed here below:

- The first consultation took place between the consultant and the proponent. The issues discussed in this first consultative meeting include the following:

- The proposed site location
- The site layout plans and designs
- The title deed
- Proposed project budget

➢ The second consultation took place between the consultant and the neighbors. After inspecting the site, the consultant approached immediate neighbors who include land owners and tenants of the area. The objectives of consultation with neighbors include;

- To disseminate and inform the area residents about the proposed project with special reference to its key components, location and expected impacts.
- To create awareness among area residents on the need for EIA for the proposed project and its due process.
- To gather comments, concerns and suggestions of the immediate neighbors.
- To ensure their concerns were known to the developer and associates at an early phase of project development planning.
- To establish a communication channel between the residents, consultants and the proponent. The consultant moved from door to door explaining the proposed project details. A questionnaire was used to elicit views of stakeholders concerning the proposed project. A sample of the neighbor's comments, occupation, contacts and signatures has been appended in this report.

There was no objection to the proposed project by any member of the neighboring community. They however reiterated that more emphasis should be put towards ensuring that the proposed project and its infrastructure would not negatively interfere with the environmental integrity of the surrounding areas. Most of those interviewed welcomed the development of this project in the area.

CHAPTER NINE: ENVIRONMENT, HEALTH AND SAFETY (EHS)

9.1 EHS Management and Administration

The EHS is a broader and holistic aspect of protecting the workers, the workplace, the tools / equipment's, and the biotic environment. It is an essential tool in determining the EIA study. The objective of the EHS on the proposed project is to develop rules that will regulate environmentally instigated diseases and occupational safety measures during construction and the operation phases of the proposed project by:

i) Avoidance of injuries

ii) Provision of safe and healthy working environment for workers comfort so as to enhance maximum output.

iii) Control of losses and damages to plants, machines, equipment and other products.

iv) Enhance environmental sustainability through developing sound conservation measures.

9.2 Policy, Administrative and Legislative Framework

It is the primary responsibility of the contractor to promote a safe and healthy environment at the workplace and within the neighborhood in which the proposed project will be constructed by implementing effective systems to prevent occupational diseases and ill-health, and to prevent damage to property. The EHS Management Plan when completed will be used as a tool and a checklist by the contracted engineers in planning and development of the construction of this alteration project.

9.3 Organization and implementation of the EHS Management Plan

The contactor shall use the EHS plan at the proposed project site both during construction and operation. The engineer will use it during construction phase with the assistance of an EHS consultant who shall enforce its provision throughout the life of the project.

9.4 The Guiding Principles to be adopted by the contractor

The company will be guided by the following principle: -

i) It will be a conscious organization committed to the promotion and maintenance of high standards of health and safety for its employees, the neighboring population and the public at large.

ii) Ensuring that EHS activities are implemented to protect the environment and prevent pollution.

iii) Management shall demonstrate commitment and exercise constant vigilance in order to provide employees, neighbors of the project and the environment, with the greatest safeguards relating to EHS.

iv) Employees will be expected to take personal responsibility for their safety, safety of colleagues and of the general public as it relates to the EHS management plan.

9.5 EHS management strategy to be adopted by the contractor

The following strategies will be adopted to achieve the above objectives:

i) Create an Environment Health and Safety Management committee and incorporate EHS as an effective structure at various levels and units to manage and oversee EHS programs in all construction and operation phases of the project

ii) Maintain an effective reporting procedure for all accidents.

iii) Provide appropriate tools and protective devices for the success of the project.

iv) Encourage, motivate, reward and support employees to take personal initiatives and commitment on EHS.

9.6 Safety Agenda for both the proponent and contractor

There will be a permanent EHS agenda during construction.

i) Contractors: - The EHS management plan code of practice shall be applicable to the contractors working in the premises, and shall be read and signed. It shall be incorporated into the contract to perform work. This should also remind the contractor of his/her;

- Legal requirements
- Statutory obligations
- Obligation to lay-down a system for reporting accidents
- Responsibility to ensure that his employees are supplied with personal protective equipment and where applicable as per the EHS management plan for the whole project.
- Responsibilities as it relates to contracting an EHS consultant in liaison with the proponent
- Obligation to ensure that he obtains detail of jobs and areas where permit-to-work must be issued

ii) All residents' and workers' responsibility: - Know the location of all safety equipment, and learn to use them efficiently

9.7 Safety requirement at the project site during construction and operation period

i) **The contractor: -** The contractor will ensure that:

- Safe means of entry and exit exist at the proposed project site.
- Ensure adequate briefing of job at hand on the safe system of work before commencement of work
- The EHS coordinator must be in attendance at all times throughout the duration of the project.
- The EHS consultant must maintain constant assessment of the risk involved as the work progresses
- A safety harness must be worn before entry into all confined spaces
- An EHS consultant must be posted at the entrance at the project site to monitor progress and safety of the persons working at the construction site.

ii) **The Traffic / Drivers: -** Within the construction premises, the following traffic rules will be observed: -

- Observe speed limits and all other signs and obey traffic rules.
- Use the vehicle for the purpose to which it is intended only.

iii) **Fire hazard at the construction site: -** Workers at the site shall ensure that: -

- Oxy-acetylene cylinders are not contaminated with grease or oil.
- Oxy-acetylene cylinders are not subjected to direct sunlight or heat.
- Oxy-acetylene cylinders are not to be used or stored standing in a vertical position.
- When in use, ensure the inclination should never be over 30˚ from the vertical.

9.8 Welding at the Construction Site

It is the responsibility of the contractor during construction to: -

i) Ensure that welding clamp is fixed such that no current passes through any moving parts of any machine.

ii) Ensure that all welding clamps are in good operating condition and conduct current without arcing at the point of contact.

iii) Ensure that welding clamps are free from any contact with explosive vapors i.e. Oil spillage, Fuel tanks, Coal dusts and miscellaneous combustible material (e.g. Cotton rags filter bags, rubber belting, and wood shavings).

iv) Ensure that any slag or molten metal arising from welding activities does not start up fires by:

- Clearing combustible material to a distance of at least 3 meters away from the working area or covering area with metal or asbestos sheet.
- Appropriate fire extinguisher is to be kept available for immediate use at all times

9.9 Emergency procedure during construction and operation

An emergency situation means:

i) Unforeseen occurrence, resulting in serious or fatal injury to employed persons or the neighboring communities

ii) Fire or explosion.

iii) Natural catastrophe

In the event of such an emergency during construction, the workers shall:

i) Alert other persons exposed to danger.

ii) Inform the EHS coordinator.

iii) Do a quick assessment on the nature of emergency.

iv) Call for ambulance on standby.

v) When emergency is over the EHS coordinator shall notify the workers by putting a message: "ALL CLEAR"

In the event of such an emergency during operation the workers shall: -

i) Alert other persons exposed to danger.

ii) Ring the nearest police station.

CHAPTER TEN: DECOMMISSIONING

Decommissioning is an important phase in the project cycle and comes last to wind up the operational activities of a particular project. Decommissioning is a controlled process used to safely retire a facility that is no longer needed. It refers to the final disposal of the project and associated materials at the expiry of the project lifespan. During decommissioning phase of a project any areas of land used for the project should be re-instated for sustainable future use. If such a stage is reached, the proponent shall remove all materials resulting from the demolition/decommissioning from the site. The following should be undertaken to restore the environment.

i) Provision of Personal Protective Equipment (PPEs) to the workers who will participate in the construction Waste from the site to be disposed in an environmentally friendly manner.

ii) Remove all underground facilities from the site

iii) The site should be well landscaped by flattening the mounds of soil and

iv) Planting indigenous trees and flowers

v) All the equipment should be removed from the site

vi) Fence and signpost unsafe areas until natural stabilization occurs

vii) Backfill surface openings if practical.

The table below shows the proposed decommissioning plan:

Table 10.1:2 ENVIRONMENTAL MANAGEMENT MONITORING PLAN FOR DECOMMISSIONING PHASE

IMPACT	MITIGATION MEASURE	RESPONSIBILITY	DURATION	COST
1 Construction Machinery/structures & Waste				
Scrap & other debris on site	- Use of an integrated solid waste management system i.e. through a hierarchy of options - Waste generated as a result of facility decommissioning activities will be characterized in compliance with standard waste management procedures. Disposal locations will be selected by the contractor based on the properties of the particular waste system - All buildings, machinery, equipment structures and tools that will not be used for other purposes should be removed and recycled/reused say in other projects - Where recycling/reuse of the machinery equipment ,implements structures tools and other waste is not possible, the materials should be disposed to approved dumpsites	Contractor Proponent, property manager	One-off	40,000

Potential Pollution	- Procedures for finding contaminated material during exaction will be established - Covering and damping of excavated materials - Appropriate storage of contaminated material if found. Ground contamination and storm water contamination will be limited on site by proper handling and storage of materials and equipment	Contractor Proponent Property Manager	0ne-off	30,000
2.Rehabilitation of project Site				
- Vegetation disturbance - Land deformation: soil erosion, drainage problems	- Implement an appropriate re-vegetation programme to restore the site to its original status - During the re-vegetation period, appropriate surface water runoff controls will be taken to prevent surface erosion. - Monitoring and inspection of the area for indication of erosion will be conducted and appropriate measures taken to correct any occurrences. - Fencing and signs restricting access be posted to minimizing disturbance to newly –vegetation areas; - Carrying out soil tests for contaminants &if need to scoop out any contaminated soils	Contractor Proponent/property manager	One-off	20,000

	and replace with uncontaminated soil from another source comprehensive landscaping			
3. Safety of the project				
Occupational hazards	- Ensures that safety measures have been effectively integrated and positioned in respective areas of the project to control and manage fire outbreaks. - Staircases and other hazardous area shall be suitably protected say using strong rails to avoid occurrence of incidences	Contractor Proponent Property manager	One-off	15,000
4.Safety and Social –Economic Impacts				
- Loss of income - Reduced ability to support dependents - Loss of quality of life	- The safety of workers should surpass as a priority of all other objectives in the decommissioning of the project - Adopt a project-completion policy; identifying key issues to be considered - Assist with re-employment and job seeking of the involved workforce. - Compensate and suitably recommend the workers to help in seeking opportunities elsewhere. - Offer advice and counselling on issues such as financial matters.	Contractor Proponent Property Manager	One-off	20,000

	- Encourage workers to register with retirement benefits schemes of their choice.			

CHAPTER ELEVEN: CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusion

The proposed project design has integrated mitigation measures with a view to ensuring compliance with all the applicable laws and procedures. The proposed project will be implemented subject to the approvals by among others, Physical Planning Department and NEMA. During project implementation and occupation, Sustainable Environmental Management (SEM) will be ensured through avoiding inadequate/inappropriate use of natural resources, conserving nature sensitively and guaranteeing a respectful and fair treatment of all people working on the project, general public at the vicinity and inhabitants of the project. In relation to the proposed mitigation measures that will be incorporated during construction phase, the development's input to the society; and cognition that the project proponent is economically and environmentally sound, establishments are considered beneficial and important. It is our considerable opinion that the proposed development is a timely venture that will help alleviate housing shortage

11.2 Recommendations

i) Ensure that worker's occupational health and safety standards are maintained through capacity building, proper training, providing protective clothing and managing their residential camps up to the required health standards.

ii) Annual environmental audits should be carried out on the project in order to ensure compliance of the project with the mitigation measures outlined in the Environmental Management Plan (EMP),

iii) All activities concerning construction and maintenance such as, work execution, site inspection, and material testing, shall be strictly monitored by an engineer or a designated official. This is important to ensure quality of maintenance works. Engineers and/or designated official shall be trained and experienced enough to judge the appropriateness of the work executed in order to carry out the monitoring properly.

iv) The proponent should therefore follow the guidelines as set by the relevant departments to safeguard and envisage environmental management principles during construction and operation/occupation phases of the proposed project.

v) It is important that warning/ informative sign (bill boards) be erected at the site. These should indicate the operation hours and when works are likely to be started and completed. The signs should be positioned in a way to be easily viewed by the public and mostly motorists.

vi) Solid waste should be disposed appropriately to avoid creation of illegal dumpsites which will finally become a health hazards in the area.

vii) All solid waste materials and debris resulting from construction activities should be transported and leveled at sites approved by the local authority engineer.

viii) All construction materials and especially pipes, pipe fittings, sand just to mention but a few should be sourced/procured from legalized dealers.

ix) Other appropriate soil erosion control measures should be adapted. Any stockpiles of earth should be enclosed, covered or sprinkled with water during dry or windy conditions to minimize generation of dust particles into the air.

x) Once earthworks have been done, restoration of the worked areas should be carried out immediately by backfilling, landscaping/ leveling and planting of suitable tree species.

xi) Proper and regular maintenance of construction machinery and equipment will reduce emission of hazardous fumes and noise resulting from friction of metal bodies. Maintenance should be conducted in a designated area and in a manner not to interfere with the environment.

xii) A fully equipped first aid kit should be provided within the site.

xiii) Workers should get food that is hygienically prepared. The source of such food should be legalized or closely controlled.

xiv) The contractor should have workmen's compensation cover and is required to comply with workmen's compensation Act as well as other relevant ordinances, regulations and Union Agreements.

xv) The contractor should provide adequate security during the construction period.

xvi) During operation phase the proponent should employ a cleaner to maintain the sanitary facilities in a clean state all the time.

xvii) The proponent should install rain water harvesting and storage facilities to supplement pipe water

xviii) Owing to the large number of tenants, unhygienic conditions may arise during periods of water shortage; the proponent should invest in water storage tanks to cater for such emergencies.

xix) The tenants should be sensitized on the need to maintain the sanitary facilities in a clean state.

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APPENDIX

i) **Questionnaires**

ii) **Design of dwellings**

iii) **Title deed**

iv) **Notification of approval**

v) **Copy of Expert's license document**